

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 9871 (DSI-9871)

UNITED STATES INCIDENT SOLAR RADIATION OBS - HOURLY VALUES

January 3, 2003

National Climatic Data Center
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Table of Contents

Topic	Page Number
1. Abstract.....	3
2. Element Names and Definitions:	3
3. Start Date.....	7
4. Stop Date.....	7
5. Coverage.....	7
6. How to order data.....	7
7. Archiving Data Center.	7
8. Technical Contact.....	8
9. Known Uncorrected Problems.....	8
10. Quality Statement.....	8
11. Essential Companion Data Sets.....	8
12. References.....	8

1. **Abstract:** NCDC has a collection of US solar radiation data. DSI-9871 contains hourly values of incident solar radiation. Major parameters included are: Global horizontal irradiance (GBL), direct beam irradiance (NIP) and diffuse irradiance (DIFF). GBL and DIFF elements are measured using a precision spectral pyranometer. NIP is measured using a precision pyrliometer. Ultra Violet global irradiance (UVB) is also measured using an Ultra Violet Biometer (Solar Light).

2. **Element Names and Definitions:** - Solar radiation data are archived by station sort (WBAN number) then date.

A. RECORDS

There are two types of records in the database - header and data. Header records precede each station's monthly data. The header records contain information about the site (latitude, longitude, elevation, etc.) and the year and month of the data. The data records are hourly average values sorted by time. Data are archived on 3480 cartridges as described below:

Record Length : Fixed 50 characters
Blocked : 15000 characters
Media : ASCII 18-Track IBM-Type 3480 cartridge
Parity : Odd
Label : ANSI Standard Labeled

B. FORMAT

(1) The Header Record is a fixed 50 character string.

LABEL	FIELD	WIDTH	POSITION
WBAN	WBAN Number	5	1-5
YR	Year of reports	4	6-9
MN	Month of reports	2	10-11
ID	Station identifier	3	12-14
WMO	WMO number	5	15-19
LAT	Latitude	5	20-24
LATHEM	Latitude hemisphere	1	25-25
LONG	Longitude	6	26-31
LONGHEM	Longitude hemisphere	1	32-32
ELEV	Elevation	5	33-37
TZSGN	Timezone Sign	1	38-38
TZ	Timezone	2	39-40
DV	Data version	1	41-41
RES	Reserved	5	42-46
SEQNUM	Sequence Number	4	47-50

Weather Bureau-Army-Navy Number (WBAN) - Site identification using WBAN. A unique five-digit number assigned to sites by NCDC.

Year (YR) - The year in which the data were observed. A four-digit number with values starting AT 1995.

Month (MN) - The month in which the data were observed. Range of values from 01 to 12.

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Station identifier (ID) - Three letter FAA call sign of the site.

WMO number (WMO) - Five-digit World Meteorological Organization number.

Latitude (LAT) - The site's latitude in thousandths of degrees.

Latitude hemisphere (LATHEM) - The hemisphere of the latitude, either "N" or "S".

Longitude (LONG) - The site's longitude in thousandths of degrees.

Longitude hemisphere (LONGHEM) - The hemisphere of the longitude, either "E" or "W".

Elevation (ELEV) - Height of the site to the nearest tenth of a meter (MSL). A "-" in the left most position indicates site is below MSL.

Timezone sign (TZSGN) - Indicates whether to add or subtract the hour in the time zone field from UTC to determine the local standard time of the site. Value can be either "-" or "+".

Timezone (TZ) - The time zone correction in number of hours to Local Standard Time from Universal Time Coordinate (UTC).

Data version (DV) - Atmospheric Research Laboratory's processing version.

Reserved (RES) - Reserved blanks

Sequence Number (SEQNUM) - Sequence number is a 4-digit sort key. All header records have a sequence number of 0000.

FIELD	1	2	3	4	5	6
ELEMENT	WBAN NUMBER	YEAR	MONTH	SITE ID	WMO NUMBER	LAT
#CHARAS	XXXXXX	XXXX	XX	XXX	XXXXXX	XXXXXX
REC POS	1-5	6-9	10-11	12-14	15-19	20-24

FIELD	7	8	9	10	11	12
ELEMENT	LAT HEMIS	LONG	LONG HEMIS	ELEV	TIME SIGN	TIME ZONE
#CHARAS	X	XXXXXX	X	XXXXX	X	XX
REC POS	25-25	26-31	32-32	33-37	38-38	39-40

FIELD	13	14	15
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ELEMENT	DATA VERSION	RESERVED	Sequence Number
#CHARAS	41	42-46	47-50

(2) The Data Records are a fixed length 50 character string. Fields are right justified and zero filled. Missing data is represented with all "9".

<u>LABEL</u>	<u>FIELD</u>	<u>WIDTH</u>	<u>POSITION</u>
WBAN	WBAN Number	5	1-5
YR	Year of report	4	6-9
MN	Month of report	2	10-11
DD	Day of Month of Report	2	12-13
HR	Hour of report	2	14-15
GBL	Global irradiance	4	16-19
IfG	Global flag	2	20-21
NIP	Direct beam irradiance	4	22-25
IfN	Direct flag	2	26-27
Diff	Diffuse irradiance	4	28-31
IfD	Diffuse flag	2	32-33
UVB	UVB global irradiance	4	34-37
RES	Reserved	9	38-46
SEQNUM	Sequence Number	4	47-50

Weather Bureau-Army-Navy Number (WBAN) - WBAN of the site. A unique five-digit number assigned to sites by NCDC.

Year (YR) - The year in which the data were observed. Range of values starting at 1994.

Month (MN) - The month in which the data were observed. Range of values is from 01 to 12.

Day of Month (DD) - The day of the month in which the data were observed. Range of values is from 01 to 31.

Hour (HR) - The hour in which the data were observed in Local Standard Time. Range of values is from 01 to 24.

Global irradiance (GBL) - Global horizontal irradiance measured using a precision spectral pyranometer. Unit is Watts per square meter (W/m^2) in whole values. Waveband ranges from 0.4 - 2.3 micrometers.

Global flag (IfG) - See "Data Quality"

Direct beam irradiance (NIP) - Direct beam irradiance measured using a precision pyrhelimeter. Unit is Watts per square meter (W/m^2) in whole values. Waveband ranges from 0.4 - 2.3 micrometers. Instrument is mounted on a sun tracker.

Direct flag (IfN) - See "Data Quality"

Diffuse irradiance (Diff) - Diffuse irradiance measured using a precision spectral pyranometer. Unit is Watts per square meter (W/m^2) in whole values. Waveband ranges from 0.4 - 2.3 micrometers.

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Instrument is mounted under a shadowband.

Diffuse flag (IfD) - See "Data Quality"

UVB global irradiance (UVB) - Ultra Violet global irradiance measure using an Ultra Violet Biometer (Solar Light). Unit is milliWatts per square meter (mW/m^2) of erythema effective irradiance in whole values. Waveband ranges from 290-320 nanometers.

Reserved (RES) - Reserved

Solar Zenith Angle (ZANGLE)

The Solar Zenith Angle is the angle in degrees between the sun and the perpendicular to the earth's surface. At sunrise it is 90 degrees, at noon it is a function of latitude, and at sunset it is again 90 degrees. Below the horizon value is 100. Values are to the nearest tenth of degree.

Sequence Number (SEQNUM) - Sequence number is a 4-digit sort key. The header record in every file has a sequence number of 0000. The first data record has a SEQNUM of 0001 and the SEQNUM increases by one for each successful data record.

FIELD	1	2	3	4	5	6
ELEMENT	WBAN NUMBER	YEAR	MONTH	DAY	HOURL	GLOBAL IRRAD
#CHARAS	XXXXXX	XXXX	XX	XX	XX	XX
REC POS	1-5	6-9	10-11	12-13	14-15	16-19

FIELD	7	8	9	10	11	12
ELEMENT	GLOBAL FLAG	DIRECT IRRAD	DIRECT FLAG	DIFFUSE IRRAD	DIFFUSE FLAG	UVB IRRAD
#CHARAS	XX	XXXX	XX	XXXX	XX	XXXX
REC POS	20-21	22-25	26-27	28-31	32-33	34-37

FIELD	13	14				
ELEMENT	RESERVED	SEQUENCE NUMBER				
#CHARAS	XXXXXXXX X	XXXX				
REC POS	38-46	47-50				

C. INSTRUMENTS AND MEASUREMENTS REPORTED

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Instrument	Measurement	Waveband	Units	Accuracy Uncrtnty	Comments
Precision spectral pyranometer	Global horizontal irradiance	0.4 - 2.3 micrometer	W/m ²	< 5%	Usually < 3%
Precision pyr heliometer (Eppley)	Normal incident irradiance	0.4 - 2.3 micrometer	W/m ²	< 2%	Mounted on sun tracker
Precision spectral pyranometer	Diffuse horizontal irradiance	0.4 - 2.3 micrometer	W/m ²	< 5%	mounted under shadowband
Ultra Violet Biometer (Solar Light)	UVB Global irradiance	290-320 nanometer	mW/m ²	< 5%	erythema effective radiation
Pyranometer (LiCOR)	Global horizontal irradiance	0.4-1.1 micrometer	W/m ²	< = 5%	silicon solid state detector
Photosynthetic active radiation (LiCOR)	Global horizontal irradiance	0.4-0.7 micrometer , RSR .2RPM	micro-Einstein /s/m ²	< = 5%	under rotating shadowband
Pyranometer (LiCOR)	Global horizontal irradiance	0.4-1.1 micrometer	W/m ²	< = 5%	under rotating shadowband
REDS Q*7.1 net radiometer	Net allwave radiation	0.25-60.0 micrometer	W/m ²	< = 5%	measured at 33m at ORT

C. Sort - 15 minute solar radiation records are sorted by station sort (WBAN number) and date.

3. **Start Date:** 19950199

4. **Stop Date:** Ongoing.

5. **Coverage:** Continental United States

6. **How to Order Data:**

Ask NCDC's Climate Services about the cost of obtaining this data set.

Phone: 828-271-4800

FAX: 828-271-4876

E-mail: NCDC.Orders@noaa.gov

7. **Archiving Data Center:**

National Climatic Data Center

Federal Building

151 Patton Avenue

Asheville, NC 28801-5001

Phone: (828) 271-4800.

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8. Technical Contact:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems: None.

10. Quality Statement: At NOAA's Atmospheric Research Laboratory in Oak Ridge, Tennessee, the data processes through a quality control procedure and daily plotting of time series. The passed 15-minute mean values are also tested against the Solar Energy Research Institute (SERI, but now National Renewable Energy Laboratory) Quality Control (SERI QC) software. The SERI QC generates flags for global, normal incident, and diffuse global radiation. This quality control primarily flags data that departs from expected limits and boundaries. Flagging convention follows:

<u>Flag</u>	<u>Description</u>
00	Untested (raw data)
01	Passed one-component test; data fall within max-min limits of K_t , K_n , or K_d
02	Passed two-component test; data fall within 0.03 of the Gompertz boundaries
03	Passed three-component test; data come within ± 0.03 of satisfying $K_t = K_n + K_d$
04	Passed visual inspection: not used by SERI_QC1
05	Failed visual inspection: not used by SERI_QC1
06	Value estimated; passes all pertinent SERI_QC tests
07	Failed one-component test; lower than allowed minimum
08	Failed one-component test; higher than allowed maximum
09	Passed three-component test but failed two-component test by 0.05
10-93	Failed two- or three- component tests in one of four ways.

To determine the test failed and the manner of failure (high or low), examine the remainder of the calculation $(\text{flag}+2)/4$.

<u>Rem</u>	<u>Failure</u>
0	Parameter too low by three-component test ($K_t = K_n + K_d$)
1	Parameter too high by three component test ($K_t = K_n + K_d$)
2	Parameter too low by two-component test (Gompertz boundary)
3	Parameter too high by two-component test (Gompertz boundary)

The magnitude of the test failure (distance in K-units) is determined from: $d = (\text{INT}(\text{flag} + 2)/4)100$.

<u>Flag</u>	<u>Description</u>
94-97	Data fails into physically impossible region where $K_n > K_t$ by K-space distances of 0.05 to 0.10 (94), 0.10 to 0.15 (95), 0.15 to 0.20 (96), and ≥ 0.20 (97).
98	Not used
99	Missing data

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11. Essential Companion Datasets: None.

12. References:

National Solar Radiation Database (1961-1990), User's Manual, National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden CO 80401.